Troubleshooting

To better help our customers - this HP Laserjet 1600 series troubleshooting page is simply a guide / additional information for your convenience, as you search for assistance in repairing your machine. Although this information is provided for your convenience it is recommended, for the most part, that a technician inspects your office equipment.

It is recommended to consult with a professional when ordering your printer part(s).

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Managing and maintenance

This chapter contains information about the following topics.

- Managing supplies
- Cleaning the printer
- Calibrating the printer

Managing supplies

Life expectancies of replacement supplies

Table 3-1 Replacement print cartridge life

Replacement print-cartridge life (based on approximately 5% coverage)	Black: 2,500 pages Yellow, cyan, and magenta: 2,000 pages each

Checking and ordering supplies

You can check the supplies status by using the printer control panel, printing a Supplies Status page, or viewing the HP Toolbox. Hewlett-Packard recommends that you place an order for a replacement print cartridge when you first receive the Order message for a print cartridge. For typical use, the Order message indicates that approximately two weeks of life remains. When you use a new, authentic HP print cartridge, you can obtain the following types of supplies information:

- Amount of cartridge remaining
- Estimated number of pages remaining
- Number of pages printed
- Other supplies information

NOTE When the printer is directly connected to a computer, you can set HP Toolbox to notify you when supplies are low.

To check status using the control panel

Do one of the following:

- Check the supplies status gauges on the printer control panel. These gauges indicate when a print cartridge is low or empty. The lights also indicate when a non-HP print cartridge is first installed.
- To print the Supplies Status page from the printer, on the printer control panel, select **Reports**, **Supplies Status**, and then (Select). See Supplies Status page on page 132 for more information.

If the supplies levels are low, you can order supplies through your local HP dealer, by telephone, or online.

To check and order supplies using HP Toolbox

You can configure HP Toolbox to notify you when the supplies are low. You can choose to receive alerts by e-mail or as a pop-up message or taskbar icon. To order supplies using the HP Toolbox, in the **Other Links** area, click **Order supplies**. You must have Internet access to connect to the Web site.

Storing supplies

Follow these guidelines for storing print cartridges:

- Do not remove the print cartridge from its package until you are ready to use it.

  CAUTION To prevent damage, do not expose the print cartridge to light for more than a few minutes.

- See Environmental specifications on page 273 for operating and storage temperature ranges.
- Store the supply in a horizontal position.
- Store the supply in a dark, dry location away from heat and magnetic sources.

Replacing and recycling supplies

Replacing the print cartridges

To install a new HP print cartridge, follow the instructions that are included on the box that contains the new supply, or see the *Getting Started Guide*.

To recycle supplies, place the used supply in the box in which the new supply arrived. Use the enclosed return label to send the used supply to HP for recycling. For complete information, see the recycling guide that is included with each new HP supply item. Go to http://www.hp.com/go/recycle for more information about HP's recycling program.

HP policy on non-HP supplies

Hewlett-Packard Company cannot recommend the use of non-HP supplies, either new or remanufactured. Because they are not HP products, HP cannot influence their design or control their quality. Service or repairs required as a result of using a non-HP supply will **not** be covered under the printer warranty.

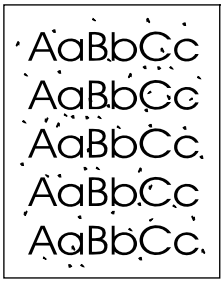
When you insert a supply into the printer, the printer will inform you if the supply is not a genuine HP supply. If you insert a genuine HP supply that has reached the low state from another HP printer, the printer identifies the supply as non-HP. Simply return the supply to the original printer to reactivate HP features and functionality.

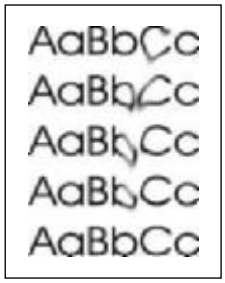
HP anti-counterfeit Web site

Visit the HP anti-counterfeit Web site at http://www.hp.com/go/anticounterfeit if the supplies status gauges or HP Toolbox indicates that the print cartridge is not an HP print cartridge and you think that it is genuine.

Cleaning the printer

During the printing process, paper, toner and dust particles can accumulate inside the printer. Over time, this buildup can cause print-quality problems such as toner specks or smearing. This printer has a cleaning mode that can correct and prevent these types of problems.





This printer has two processes for generating cleaning pages: one is automatically generated and one is manually generated. When a new black print cartridge is installed, a cleaning page will be automatically generated prior to calibration. To manually generate a cleaning page, see To clean the fuser using HP Toolbox on page 33.

To clean the printer at the printer

NOTE If you have access to HP Toolbox, HP recommends cleaning the paper path by using HP Toolbox.

Use the following procedure to clean the printer at the printer.

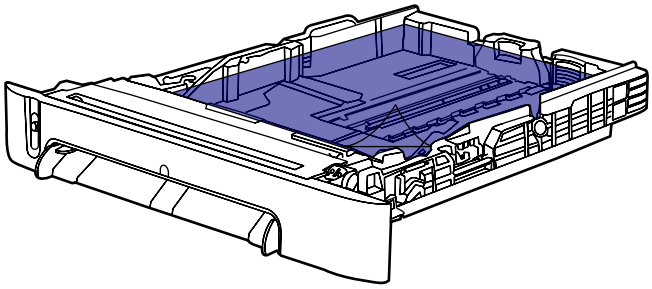
1. Use the (Left arrow) or (Right arrow) button to select **Service**, and then press (Select).
2. Use the (Left arrow) or (Right arrow) button to select **Cleaning Mode**, and then press (Select).

   A page feeds through the printer slowly. Discard the page when the process is completed.

To clean the fuser using HP Toolbox

NOTE Use the following procedure to clean the fuser using the HP Toolbox. To clean the engine when the computer is running an operating system that does not support HP Toolbox, see the late-breaking Readme on the root of the CD-ROM, or visit http://www.hp.com/support/clj1600.

1. Make sure that the printer is turned on and in the Ready state.
2. Open the HP Toolbox.
3. On the **Troubleshooting** tab, click **Troubleshooting Tools**, and then click **Print**. A page with a pattern prints from the printer.
4. At the printer, remove any print media in Tray 2 or optional Tray 3.
5. Remove the page that printed and load it face-down into Tray 2 or optional Tray 3.



6. On the **Troubleshooting Tools** page, click the **Clean** button.

Cleaning spilled toner

Defective print cartridges can develop leaks. Also, after a paper jam has occurred, some toner might remain on the rollers and guides inside the printer. The pages that print immediately after the jam can pick up this toner.

CAUTION When cleaning the printer, do not touch the ETB with a damp cloth or with your fingers.

Calibrating the printer

The printer automatically calibrates at various times. You can adjust the calibration settings by using the HP Toolbox.

Environmental differences or aging print cartridges might cause fluctuations in image density. The printer accounts for this with image stabilization control. The printer automatically calibrates at various times to maintain the highest level of print quality. You can also request a calibration by using the HP Toolbox.

The printer does not interrupt a print job to calibrate. It waits until the job is complete before calibrating or cleaning. While the printer is calibrating, it pauses printing for the time that is required to complete the calibration.

To calibrate the printer at the printer

1. To calibrate from the printer, press (Left arrow) or (Right arrow) until the display reads **SYSTEM SETUP**.
2. Press (Select).
3. Press (Left arrow) or (Right arrow) until the display reads **PRINT QUALITY**.
4. Press (Select).
5. Press (Left arrow) or (Right arrow) until the display reads **CALIBRATE COLOR**.
6. Press (Select).
7. Press (Left arrow) or (Right arrow) until the display reads **CALIBRATE NOW**.
8. Press (Select).
9. Press (Select) to confirm **CALIBRATE NOW**.

To calibrate the printer from the HP Toolbox

1. Open the HP Toolbox in one of these ways:
   - On the desktop, double-click the **HP Toolbox** icon.
   - On the **Start** menu, point to **Programs**, point to **HP**, point to **HP Color LaserJet 1600**, and click **HP Color LaserJet 1600 Toolbox**.
2. Click the **Troubleshooting** tab and then click **Troubleshooting Tools** (on the left side of the screen).
3. In the Calibration section, click **CALIBRATE NOW**.

Operational theory

This chapter contains information about the following topics.

- Engine control system
- Image formation system
- Pickup and feed system
- Service-only tools (service only)

Engine control system

Basic sequence of operation

The operational sequence of the printer is controlled by the microcomputer on the DC controller printed circuit board (PCB). The purposes of each period, from power-on until the main motor stops after the completion of printing, are listed below. See General timing chart on page 56 for a detailed timing chart.

Table 4-1 Basic operational sequence

	Period	Purpose	Remarks
WAIT (wait period)	From power-on until the end of the main motor initial drive.	To clear the drum surface potential and to clean the ETB.	Detects whether or not the print cartridge is installed.
STBY (standby period)	From the end of WAIT or LSTR until the input of print command from the formatter. Or, from the end of LSTR until power-off.	To keep the printer ready to print.	
INTR (initial rotation period)	From the input of print command from the formatter until the pick-up solenoid is turned on.	To stablize the photosensitive drum sensitivity for print preparation.	
PRINT (print period)	From the end of INTR until the developing high-voltage is off.	To form the image on the photosensitive drum based on the VIDEO signals input from the formatter, and to transfer the toner image onto paper.	
LSTR (last rotation period	From the developing high-voltage off until the main motor stops rotating.	To deliver the last page completely. Also used to clean the ETB.	The printer enters INTR after the end of LSTR, when the print command is input from the formatter.

The engine control system coordinates all printer functions. It drives the laser/scanner system, the image formation system, and the pickup and feed system. The engine control system contains the following components:

- DC controller PCB
- Low-voltage power supply unit
- High-voltage power supply PCB

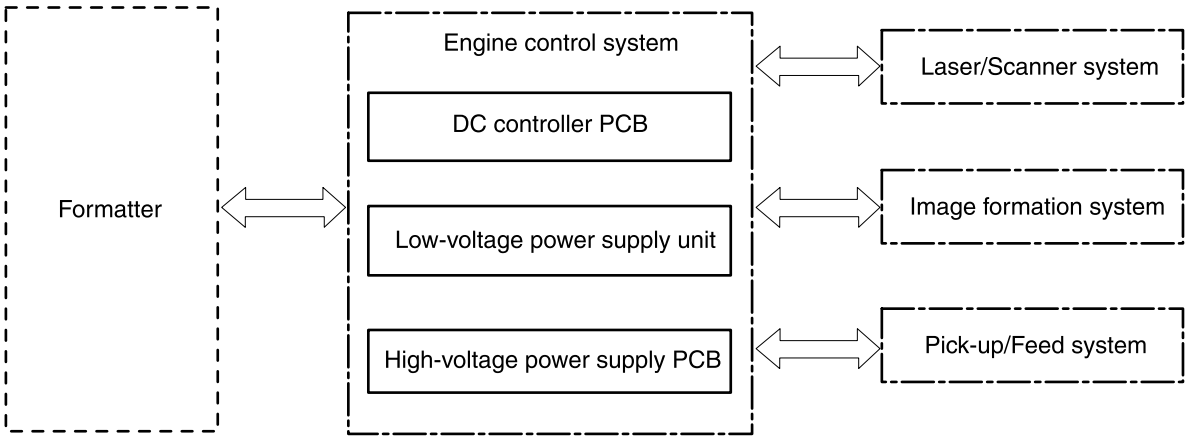


Figure 4-1 Engine control system

Power-on sequence

The power-on sequence is for the purpose of the printer initialization and checking for possible malfunctions.

The following is the sequence from when the printer is turned on until it enters STBY mode.

1. Power on
2. Central processing unit (CPU) initialization
3. ASIC initialization
4. Video interface communication start
5. Residual paper check by each sensor signaling paper presence
6. Initial drive for main motor, pickup motor, and fuser/delivery motor
7. Fuser heater initial drive by controlling fuser temperature targeting for 100°C
8. Initial drive for scanner motor
9. Failure/Abnormality check
    - Detect scanner failure
    - Fuser failure
    - Door open during the above periods
10. Communication with memory tag
11. Cartridge presence detection

Motors and fans

The DC controller PCB controls four motors.

The specifications of each motor are listed in the following table.

Table 4-2 Motor specifications

Name		Purpose	Type	Direction of rotation	Failure detection
Motor	Main motor (M1)	Drive ETB belt, photosensitive drum and developing cylinder	DC motor	CW	Yes
	Fuser/delivery motor (M2)	Drive fuser pressure roller, delivery roller and automatic release of fuser pressure	Stepping motor	CW/CCW	No
	Pickup motor (M3)	Drive pickup roller and registration roller	Stepping motor	CW	No
	Fan (FM1)	Cool down around cartridge	DC motor	—	Yes

Main motor failure detection

The CPU determines the main motor failure, stops the printer, and notifies the formatter of error status, when it encounters the following conditions.

- Main motor start-up abnormality

  The interval of the MAIN MOTOR SPEED DETECTION signal (/MAINMFG) does not become the specified interval after 1000 ms of the main motor drive start.

- Main motor rotation abnormality

  The interval of the /MAINMFG signal stays at an irregular interval for 100 ms and longer after once it has become the specified interval.

Fan motor failure detection

The CPU determines the fan motor failure and notifies the formatter when it encounters the following condition.

The FAN LOCK signal (FANLCK) is “H” for approximately 10 seconds and longer during fan motor rotation.

Image formation system

The image formation system serves as the nerve center of the printer and forms a toner image on paper. It is controlled by the DC controller. The DC controller controls the laser/scanner unit and the high-voltage power supply PCB to form an image on paper according to the VIDEO signals (VDO, /VDO) upon reception of a print command from the formatter. There is a memory tag inside each cartridge. The memory tags read and write data according to the command from the DC controller.

The following figure illustrates the image formation system.

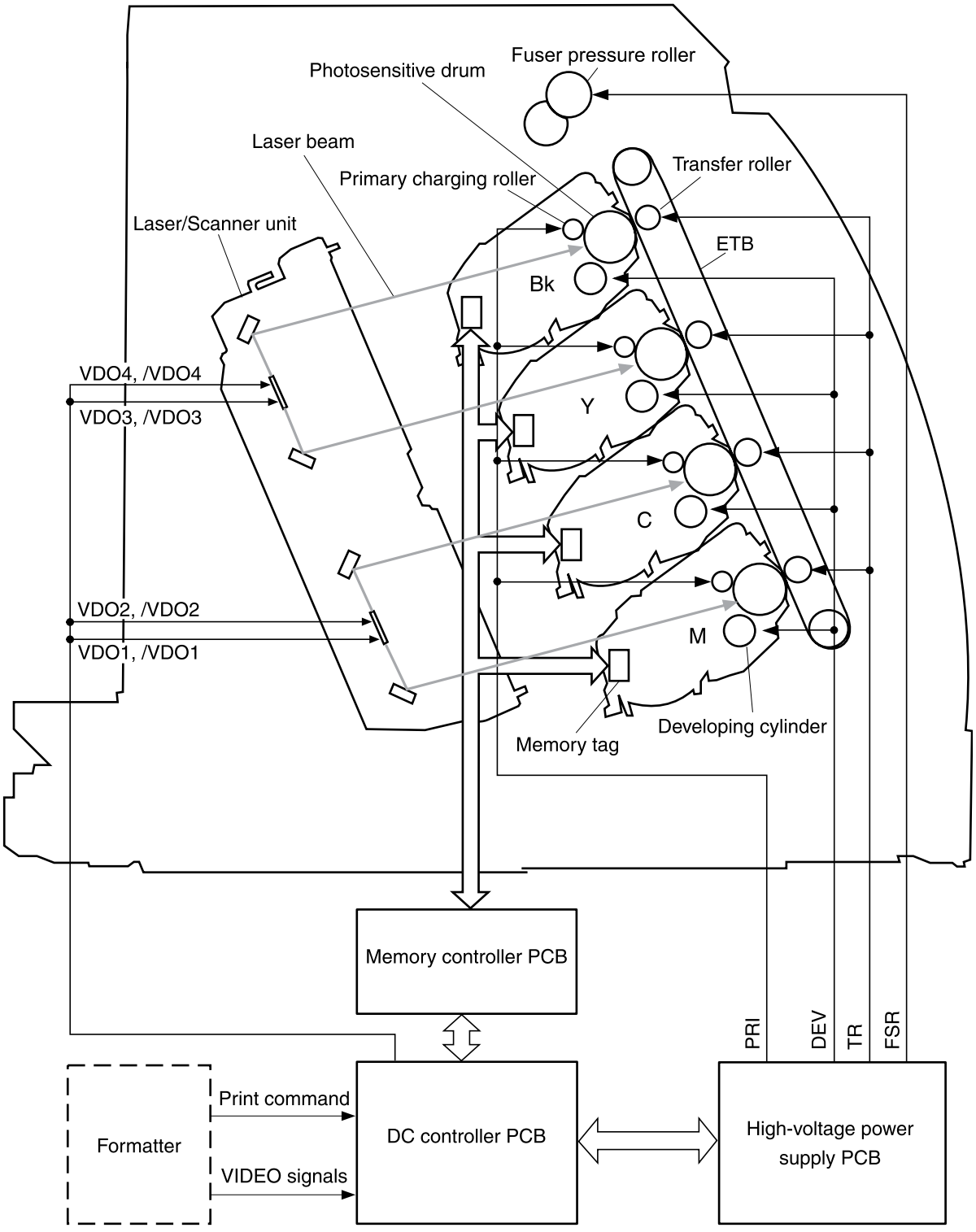


Figure 4-2 Image formation system

Image formation process

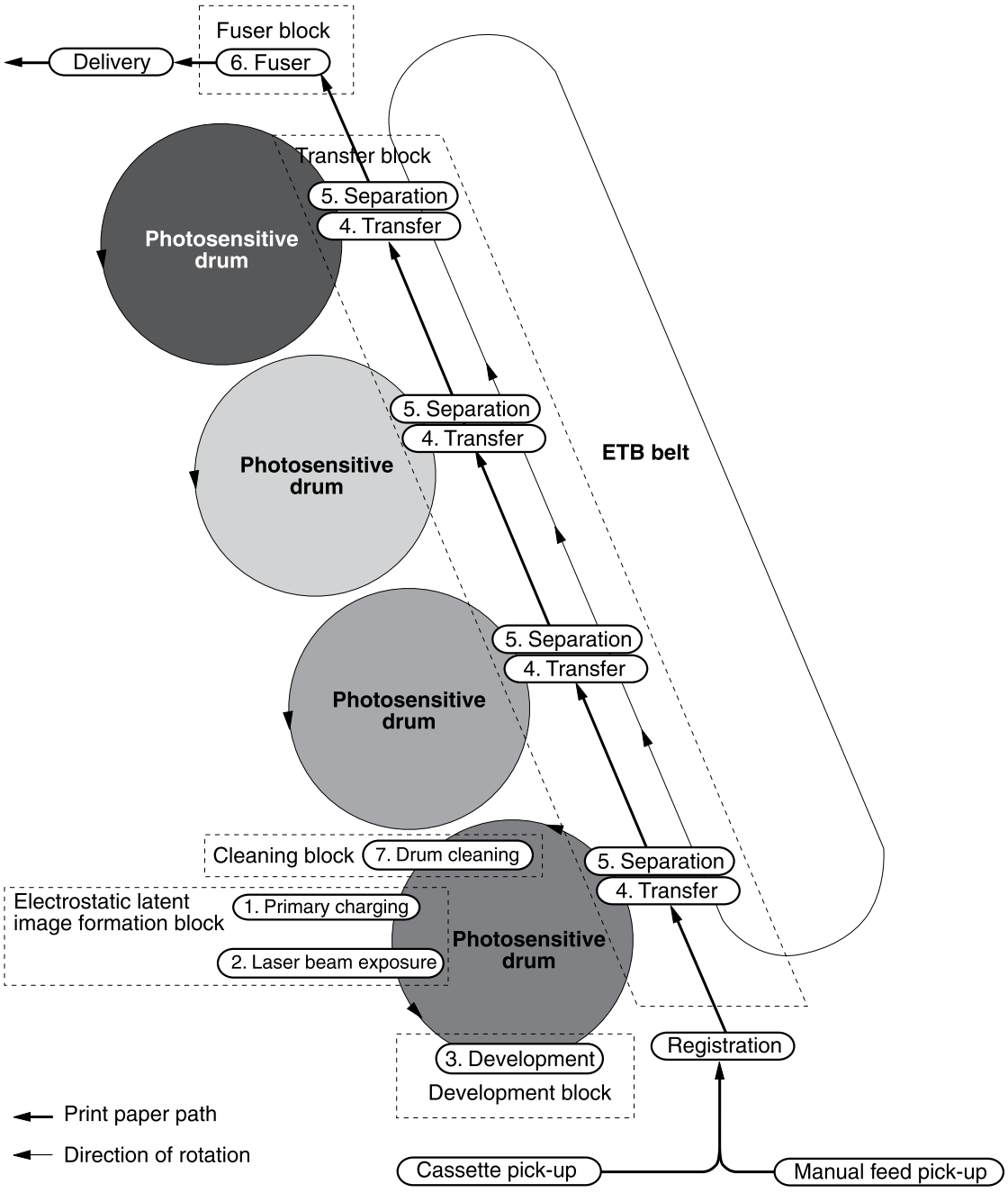


Figure 4-3 Image formation process

The principal process of image formation is described here. The print process can be broadly divided into 5 stages with 7 steps. A toner image is formed on paper as it goes through each process. The following figure illustrates the stages and steps of the print process as follows.

1. **Electrostatic latent image formation stage**

   Forms an electrostatic latent image on the photosensitive drum.

   Step 1: Primary charging

   Step 2: Laser beam exposure

2. **Developing stage**

   Makes the electrostatic latent image on the photosensitive drum surface visible by applying toner.

   Step 3: Development

3. **Transfer stage**

   Transfers a toner image on the photosensitive drum onto paper.

   Step 4: Transfer

   Step 5: Separation

4. **Fuser stage**

   Fuses the toner image on paper.

   Step 6: Fuser

5. **ETB cleaning stage**

   Cleans the residual toner on the photosensitive drum.

   Step 7: ETB cleaning

Latent image formation

This stage consists of two steps and forms an electrostatic latent image on the photosensitive drum.

When the last step in this stage is completed, a negative electrical charge remains in the unexposed drum surface area by the laser beam and is removed from the exposed area. The image with negative charge on the drum is called an “electrostatic latent image” as it is invisible to human eyes.

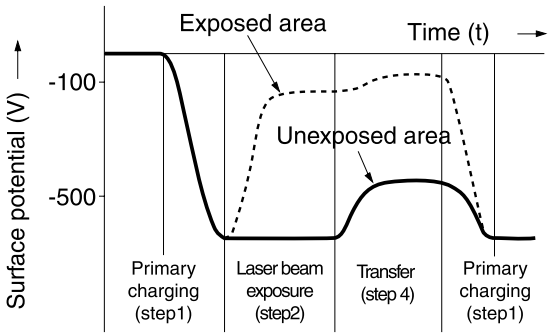


Figure 4-4 Latent image formation

Laser/scanner system

The laser/scanner system forms latent images on the photosensitive drum according to the VIDEO signals sent from the formatter. It consists of the laser driver PCB, the scanner motor, and so forth. The figure below illustrates the laser/scanner unit.

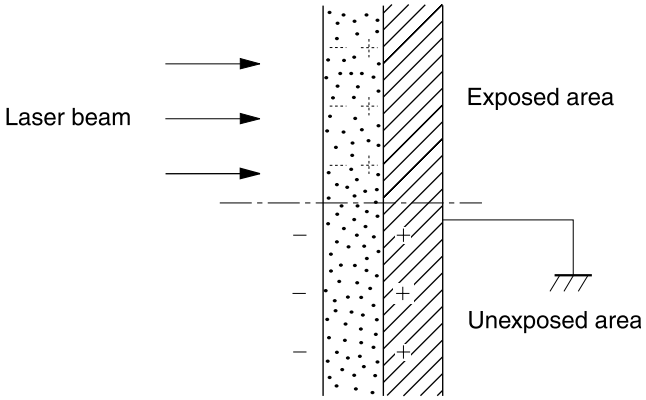


Figure 4-5 Laser beam exposure

Developing stage

The electrostatic latent image on the photosensitive drum surface is visualized by applying the toner in this process. This printer utilizes the projection development method by the non-magnetic, single-component toner.

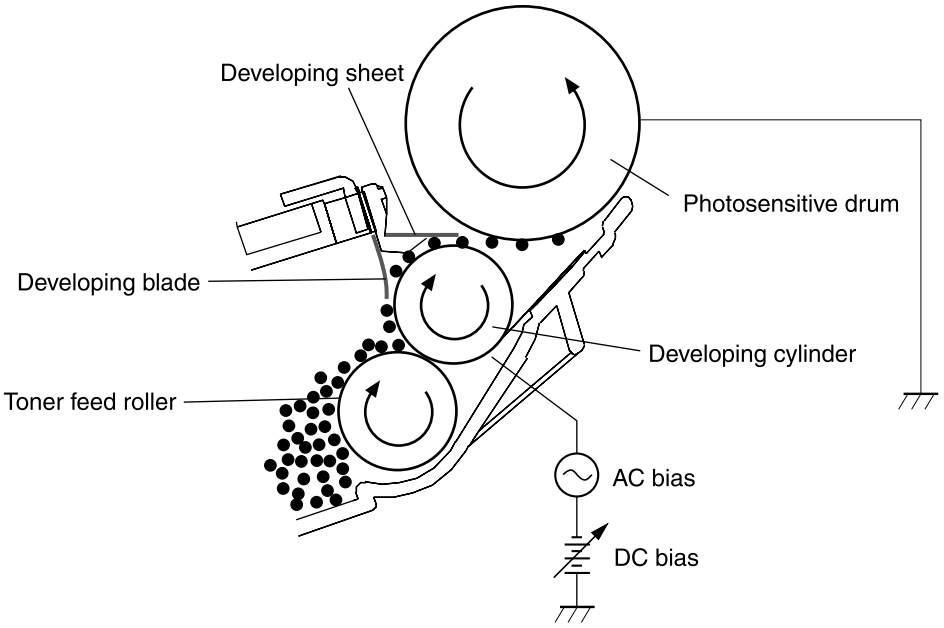


Figure 4-6 Developing stage

The toner has an insulating property and has negative charge potential from friction with the rotating developing cylinder and the developing blade surface.

The area of the photosensitive drum, where the laser beam is exposed, has higher potential than the toner, which is charged negatively on the cylinder. When this area contacts the toner layer (negatively charged), the toner jumps onto the drum surface by the potential difference between the drum surface and the cylinder (higher potential on drum side). This is called the projection development and it visualizes the electrostatic latent image on the drum. The developing cylinder is applied the AC bias in order to make the toner jump easier onto the drum surface and improve the contrast of the output image.

This printer is able to adjust the image density by changing the potential difference between the cylinder and the photosensitive drum surface according to changes of the developing DC bias based on the IMAGE DENSITY INFORMATION signal sent from the formatter.

The developing sheet improves the print quality and also prevents toner scattering.

Print cartridge

The cartridge forms a visible toner image on the photosensitive drum. There are four print cartridges: magenta, cyan, yellow, and black; each having identical structure.

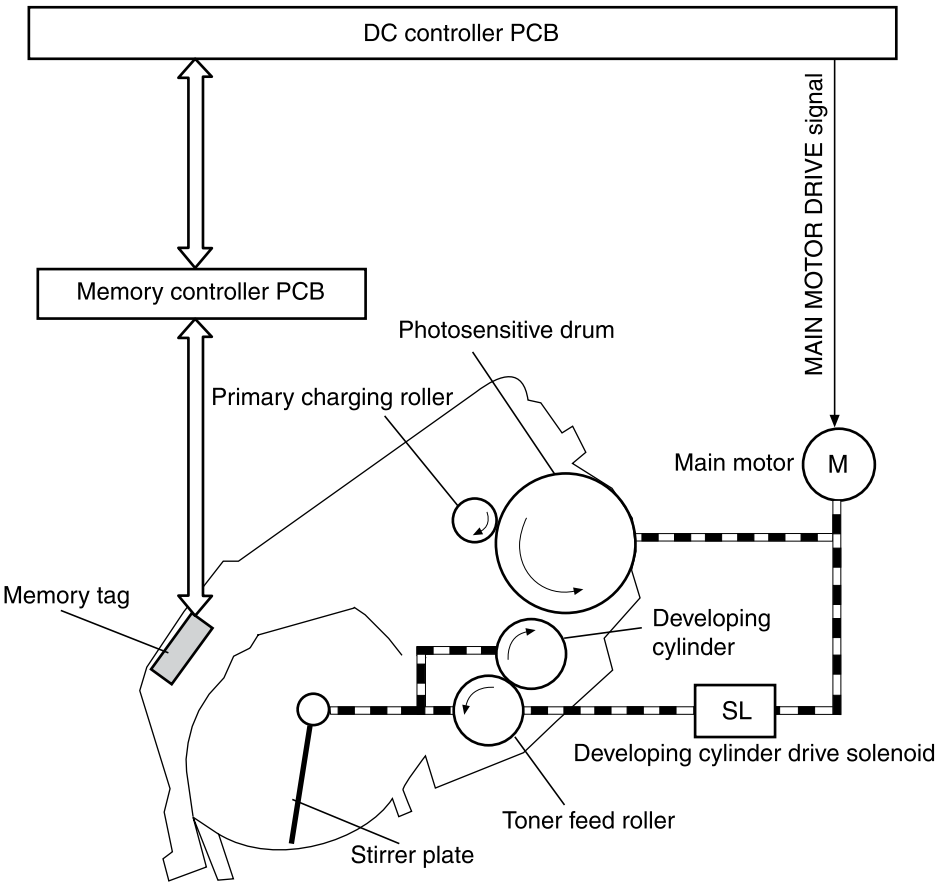


Figure 4-7 Print cartridge structure

Transfer belt (ETB)

The ETB unit feeds paper as well as transfers toner onto the paper.

The ETB unit consists of the ETB, ETB feed roller, ETB driven roller, and color misregistration/ density sensor unit.

As the main motor rotates the ETB feed roller, the ETB feed roller rotates the ETB belt. The transfer roller and the ETB driven roller are engaged with the ETB.

During printing, the picked up paper is conveyed in between the ETB and the photosensitive drum, and simultaneously the toner image is transferred onto the paper. The ETB is also used for color misregistration corrective control and the image stabilization control. The pattern image for the color misregistration or image density determination is transferred onto the belt. This pattern image is read in the color misregistration/density sensor unit.

The following is the diagrammatic sketch of the ETB unit.

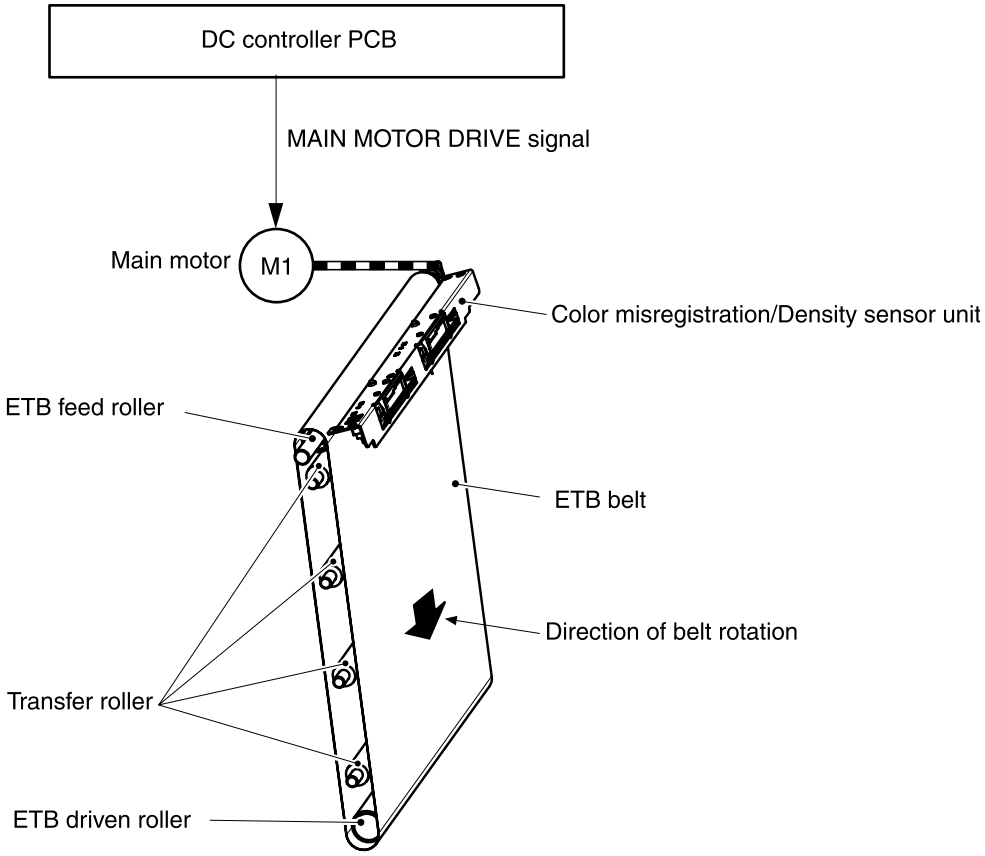


Figure 4-8 ETB unit

Transfer stage

The transfer stage is to transfer the toner image on the photosensitive drum surface onto paper.

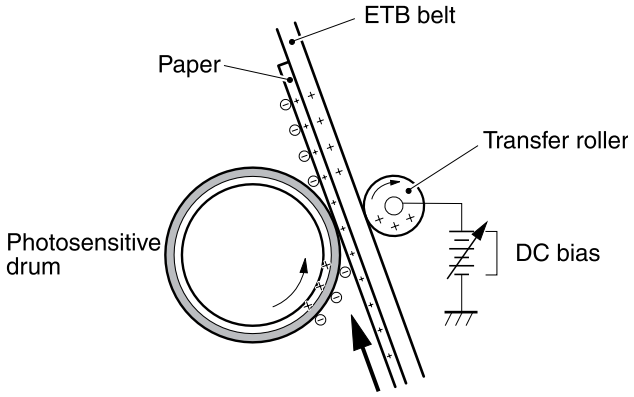


Figure 4-9 Transfer stage

The toner on the photosensitive drum surface is transferred onto the paper according to the positive charge from the back side of the paper. Each color's toner image is transferred in order of M, C, Y, and K, and forms one toner image overlaying one color's image on another.

Separation stage

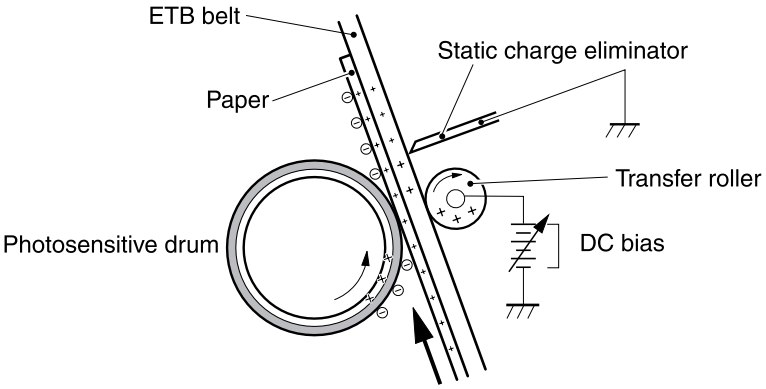


Figure 4-10 Separation stage

The paper is separated from the drum by its elasticity (Curvature Separation). The static charge on the back side of the paper is decreased with the electrostatic eliminator in order to stablize the feeding operation and prevent the crescent spots of printing image under the low temperature and low humidity environment.

Fusing stage

The toner image is fused onto the paper in this stage. The toner image transferred onto the paper through the transfer stage can be smeared easily by hands since it is only attracted to the paper by the static electricity. The paper and the toner on it are fused by pressure, fused and secondary colored by heat to be a permanent image.

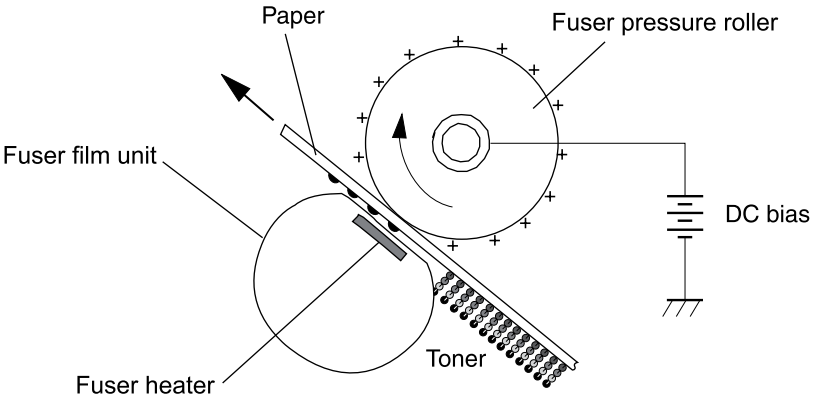


Figure 4-11 Fusing stage

The toner image on the paper is fused onto the paper by using the on-demand fuser method in this step. This printer utilizes the ceramic heater with lower heat capacity, which warms up quickly, does

not require the power supply during STBY mode, and saves energy. As for the printer, the DC positive bias is applied to the fuser pressure roller, so the transferred toner stays harder on the paper and toner scattering to the fuser film (offset) is prevented.

Pickup and feed system

The pickup/feed system, which picks up and feeds paper, consists of the various feed rollers. This printer has two pickup sources: the cassette and the manual feed slot, and one delivery source: the face-down tray. The following components are part of the pickup and feed system:

- Manual feed slot paper sensor (SR3): detects the presence of paper in the manual feed slot
- Cassette paper sensor (SR2): detects the presence of paper in the cassette
- DC controller controls the following to drive each feed roller:
  - Main motor (M1)
  - Fuser/delivery motor (M2)
  - Pickup motor (M3)
  - Solenoid (SL1)
  - Solenoid (SL2)
  - Solenoid (SL3)
- Photo sensors:
  - SR1, SR4, and SR5 on the paper transport path detect the arrival and passage of paper
  - SR9 detects the fuser pressure roller alienation in the fuser
  - SR8 detects the paper width

The figure below illustrates the motors, solenoids, and sensors.

NOTE There is a short pause before the paper is picked up.

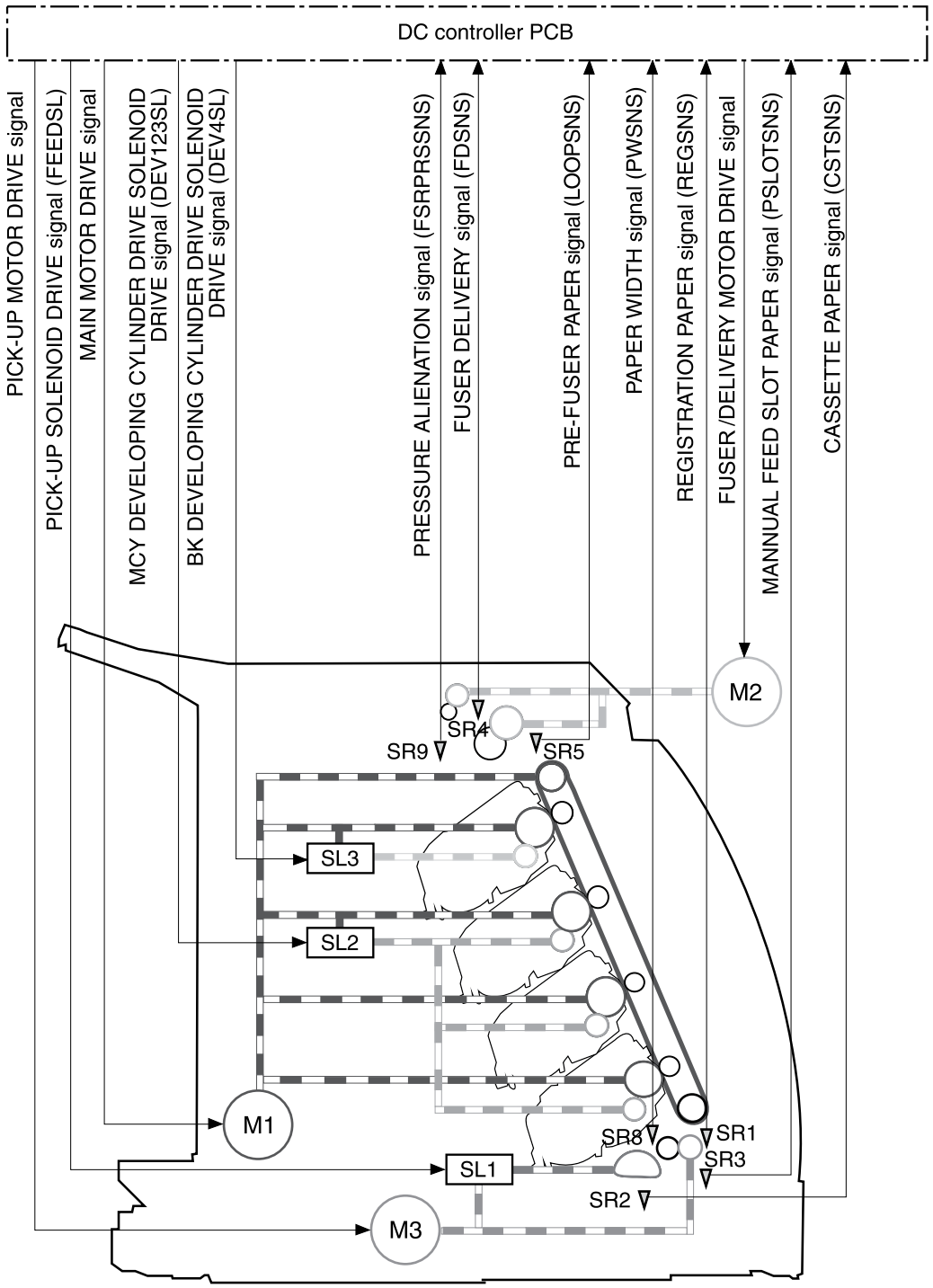


Figure 4-12 Paper pickup and feed system

SR1	Registration paper sensor
SR2	Cassette paper sensor
SR3	Manual feed slot paper sensor

SR4	Fuser delivery paper sensor
SR5	Pre-fuser paper sensor
SR8	Paper width sensor
SR9	Pressure alienation sensor
M1	Main motor
M2	Fuser/Delivery motor
M3	Pickup motor
SL1	Cassette pickup solenoid
SL2	Magenta, cyan, and yellow developing cylinder drive solenoid
SL3	Black developing cylinder drive solenoid

Manual feed slot pickup mechanism

This mechanism picks up one sheet of paper only that is inserted into the manual feed slot and then into the printer. This printer does not have a pickup roller in the manual feed slot. Instead of a pickup roller, the registration roller picks up paper. The presence of paper in the manual feed slot is detected by the manual feed slot paper sensor (SR3). The following is the operational sequence of the manual feed slot pickup.

1. If paper is set into the manual feed slot during STBY mode, the manual feed slot paper sensor (SR3) detects it.
2. When the paper is detected, the DC controller drives the pickup motor (M3) for 5 seconds. The paper is fed approximately 5 mm (0.2 inch) and is then caught by the registration roller.
3. After the above operational sequence, the paper is fed by the drive of the registration roller.

Paper feed mechanism

This mechanism feeds one sheet of picked up paper to the fuser. There is a paper width sensor in the paper transport path to prevent temperature rise at the end of the fuser. It detects paper with widths of shorter than 190 mm (7.5 inches). The following is the operational sequence of paper feed.

1. Paper skew is corrected by the registration shutter when the paper is fed into the printer.
2. Toner is transfered to the paper from the photosensitive drum and then the paper is fed to the fuser/delivery stage.

Skew correction by the registration shutter

If the paper fed into the printer is skewed, when it hits the registration shutter, it will be adjusted. Figure 4-13 Skew correction on page 52 illustrates how skewed paper is corrected by the registration shutter.

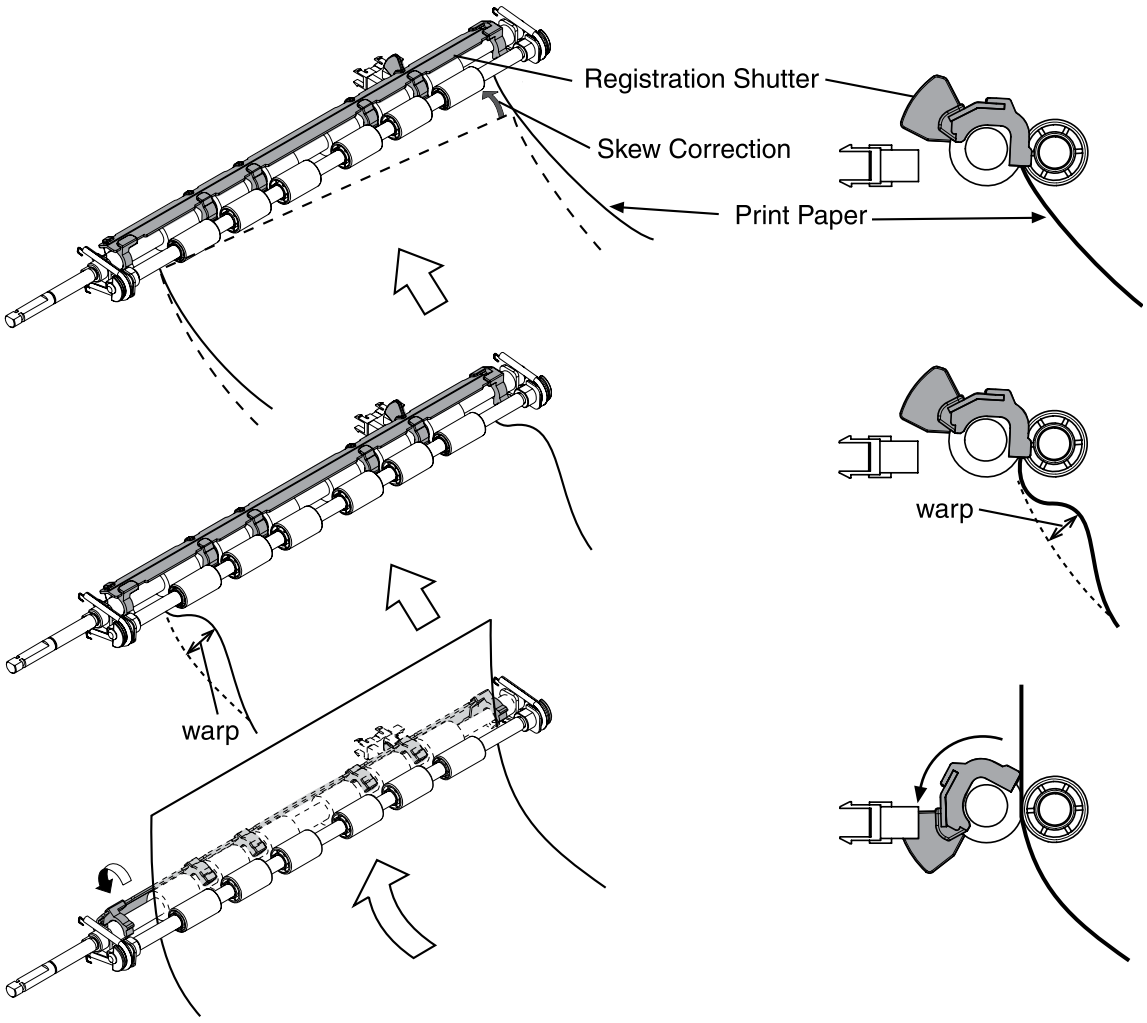


Figure 4-13 Skew correction

Jam detection

This printer is provided with the following paper detection sensors to detect the presence of paper and whether or not the paper feed is operating normally.

- Registration paper sensor (SR1)
- Pre-fuser paper sensor (SR5)
- Fuser delivery paper sensor (SR4)

The CPU determines a paper jam by checking whether or not paper is present at the sensor at the check timing. The check timing is stored in the memory of the CPU. If the CPU determines a jam, it stops the print operation and notifies the formatter of a jam occurrence.

For more information, see Clearing jams on page 100.

Solenoid, motor, and fan locations

The following illustration shows the locations of the solenoids, motor, and fan.

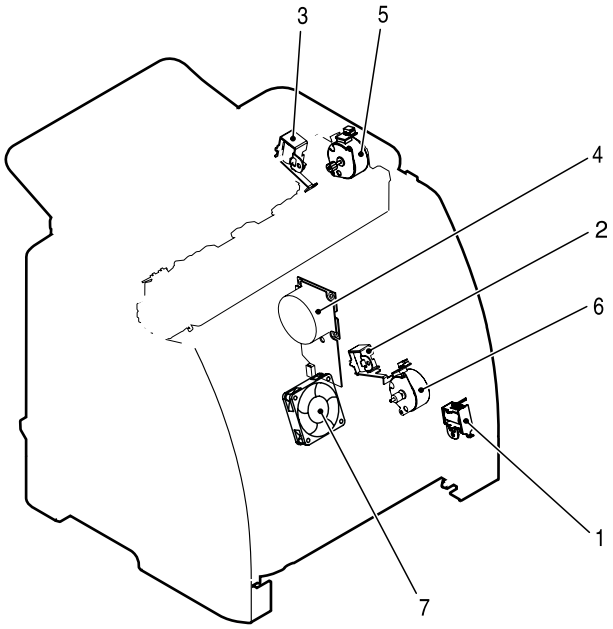


Figure 4-14 Location of solenoids, motors, and fans

1	Pickup solenoid (SL1)
2	Magenta, cyan, and yellow developing cylinder drive solenoid (SL2)
3	Black developing cylinder drive solenoid (SL3)
4	Main motor (M1)
5	Fusing/delivery motor (M2)
6	Pickup motor (M3)
7	Fan (FM1)

Printed circuit assembly locations

The following illustration shows the locations of the printed circuit assemblies. Location of the printed circuit assemblies and list of parts are also identified in Figure 7-11 PCB assembly location (Tray 2) on page 186.

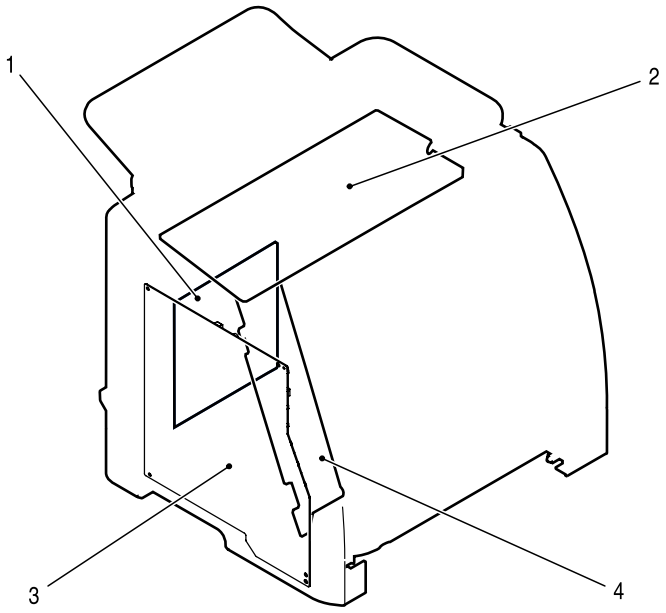


Figure 4-15 Location of printed circuit assemblies

1	DC controller PCB
2	Low-voltage power supply PCB
3	High-voltage power supply PCB
4	Memory controller PCB

250-sheet tray solenoid and printed circuit locations

The following illustration shows the locations of the 250-sheet tray solenoid and printed circuit assembly.

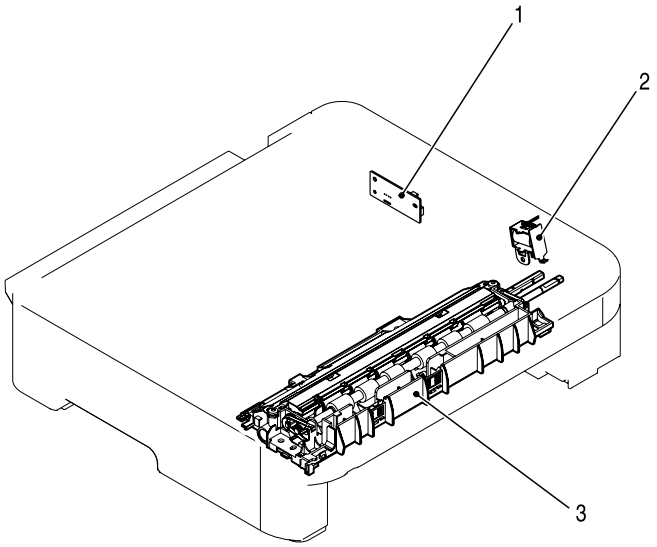
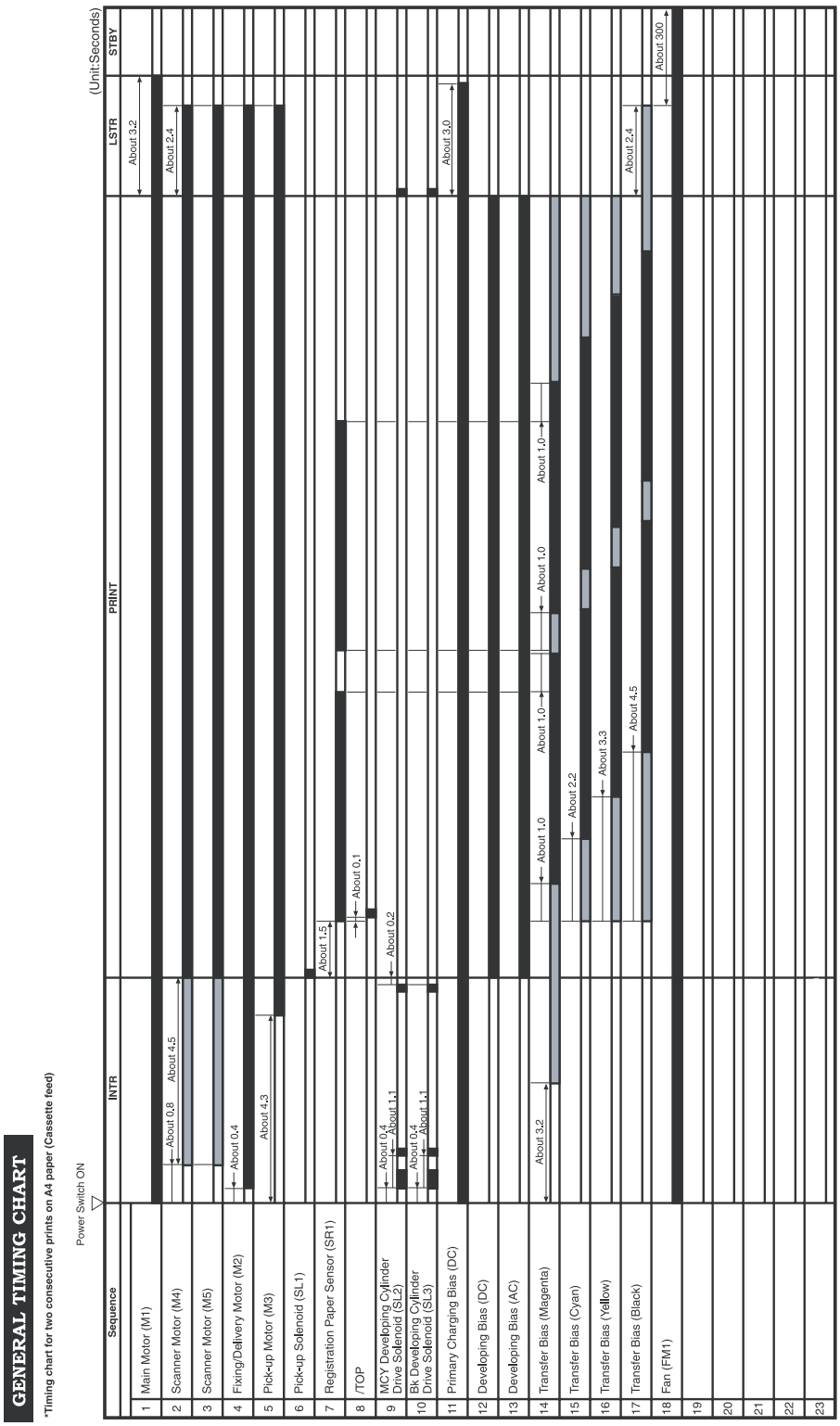


Figure 4-16 Location of 250-sheet tray solenoid and printed circuit assembly

1	Paper feeder PCB
2	Paper feeder pickup solenoid (SL-4)
3	Paper pickup feeder unit

Service-only tools (service only)

General timing chart



Printer calibration

Calibration settings are configured with Printer Management Language (PML)/Printer Job Language (PJL) commands, except for new cartridge installation. Calibration can also be configured using the HP Toolbox. Calibration occurs during the following conditions and intervals:

- **Power-on calibration**

  Calibration during power-on can be configured for the following intervals:

  - Always calibrate at power-on
  - Never calibrate at power-on
  - Calibrate after 1-6 minutes (default is 15 minutes) of idle time after the first job since the printer was turned on or 12, 24, 48, 96, or 168 hours (default is 48 hours) of idle time.

- **Page count calibration**

  Calibration occurs at the end of the first job that passes 150 color pages since the previous calibration occurred. Page count calibration settings can be configured for the following intervals:

  - Do not do page count calibrations
  - Calibrate after 150 pages have been printed since the last calibration. This is the default setting.

- **Elapsed time calibration**

  Elapsed time calibration will occur when the first job is sent after the elapsed time is exceeded. Use PML/PJL commands to configure the following intervals:

  - Do not perform elapsed time calibration
  - After 12, 24, 48, 96, or 168 hours (default is 48 hours) or more have elapsed since the last calibration (or power-on), and after 1-6 minutes (default is 15 minutes) of idle time from the first job after 12, 24, 48, 96, or 168 hours (default is 48 hours) have elapsed.

- **On-demand calibration**

  Calibrate the printer using the printer control panel. For more information about printer calibration, see Printer calibration on page 146.

- **New consumable calibration**

  When a new print cartridge is installed, the printer will calibrate.

  NOTE When a new black print cartridge is replaced, a cleaning page will print before the printer calibrates.

  If printing stops when the cartridge is out, requiring the user to either install a new cartridge or select to print with toner out override, a calibration will not occur until the depleted cartridge is replaced, printing resumes, and all jobs currently in the queue are finished or cancelled. This could result in an interval of several pages where a new cartridge is using the old cartridge's calibration data.

Calibrating the printer at the control panel

Use the following steps to calibrate the printer using the printer control panel.

1. Use the (Left arrow) or the (Right arrow) button to select **SYSTEM SETUP** and then press (Select).
2. Use the (Left arrow) or the (Right arrow) button to select **PRINT QUALITY** and then press (Select). **CALIBRATE COLOR** will display on the control panel.
3. Press (Select).
4. Use the (Left arrow) or the (Right arrow) button to select **CALIBRATE NOW** and then press (Select).
5. Press (Select) to start the calibration.